RESEARCH ARTICLE

Assessment of Seed Yield Stability and Genotype × Environment Interaction of Faba Bean (*Vicia faba* L.) Promising Lines Using AMMI Analysis

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ABSTRACT

Sheikh, F., Sekhavat, R. Asteraki, H., and Parkasi, A. 2021. Assessment of seed yield stability and genotype × environment interaction of faba bean (*Vicia faba* L.) promising lines using AMMI analysis. **Seed and Plant Journal 37:** 1-22 (in Persian).

This study was carried to assess seed yield stability and genotype × environment interaction of 15 faba bean promising lines together with four control cultivars using randomized complete block design with three replications in four experimental field stations; Gorgan (rainfed), Dezful (irrigated), Borujerd (rainfed), Iranshahr (irrigated), in two cropping seasons (2015 -17). Combined analysis of variance showed that genotypes differed significantly for days to 50% flowering, plant height, number of pods per plant, number of seeds per pod, 100-seed weight and seed yield. FLIP03-069FB, ILB1266 × ILB1814 and WRB2-7 × Giza Blanca promising lines had the highest seed yield, respectively. Environment main effect accounted for 76.43% of total observed variation in seed yield, whereas genotype and genotype × environment interaction effect accounted for 6.31% and 17%, respectively. The multivariate analysis using additive main effects and multiplicative interaction (AMMI) showed that the six first principal components had significant effect in explaining genotype × environment interaction effect, and explained 99.69% of the total of observed variation. The AMMI stability value (ASV) discriminated WRB2-7 × Giza Blanca, ILB 3626, Barkat × BPL 465 promising lines and cv. Barkat with high seed yield stability, respectively. Barkat × New Mammoth promising line and cv. Zereshki had low seed yield stability, respectively. Also, Gorgan and Borujerd environments, due to their high interaction, were identified as the ideal environments for discriminating faba bean genotypes. In conclusion, WRB2-7 × Giza Blanca promising line with average seed yield of 3285 kg ha^{-1}, high yield stability and wide adaptation was identified as the superior genotype for being released as new commercial faba bean cultivar for target regions.

Keywords: Faba bean, additive main effect and multiplicative interaction, AMMI stability value, seed yield and ideal environment.

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RESEARCH ARTICLE

Boron × Rootstock Interaction Effect on Growth, Physiological and Biochemical Characteristics of Apple cv. Golden Delicious

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ABSTRACT

Hassani, Gh., Majidi, A., Farrokhzad, A., and Sepehr, E. 2021. Boron × rootstock interaction effect on growth, physiological and biochemical characteristics of apple cv. Golden Delicious**. Seed and Plant Journal 37:** 23-39 (in Persian).

Boron toxicity is considered as one of the most important plant growth disorders in arid and semiarid regions. This experiment was carried out in order to evaluate boron (B) × rootstock interaction effect on growth, physiological and biochemical characteristics of apple cv. Golden Delicious. In this study, boron was applied at five concentration levels (0, 15, 30, 45 and 60 mg kg^{-1} soil) on four rootstocks; MM106, M26, M9 and P22 in two years. Results revealed that with increases in boron supply; plant height, LAI, leaf fresh and dry weight, chlorophyll index and vegetative growth reduced in all rootstocks as compared to control. Vegetative growth on all rootstocks stopped as boron level increased, except in M26 and P22, however, vegetative growth in M26 and P22 reduced in comparison with control. Also, electrolyte leakage and malondialdehid increased as boron level increased in soil. Leaf superoxide dismutase activity increased in 0 to 30 mg kg^{-1} boron, and then decreased with increasing boron levels in soil. Leaf boron concentration in M26 and P22 was less than other rootstocks. Results indicated that cv. Golden Delicious on M26 rootstock was more tolerant to boron toxicity than on other rootstocks in more than 30 mg kg^{-1} boron in soil.

Keywords: Superoxide dismutase, chlorophyll index, boron toxicity, rootstock, electrolyte leakage.

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RESEARCH ARTICLE

Vegetative Characteristics and Early Bearing of Some Fire Blight Tolerant European Pear Cultivars on Semi-Dwarfing Pyrodwarf® and OH × F87TM Rootstocks

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ABSTRACT

Abdollahi, H., and Hassani, H. 2021. Vegetative characteristics and early bearing of some fire blight tolerant European pear cultivars on semi-dwarfing Pyrodwarf® and OH × F87^{TM} rootstocks**. Seed and Plant Journal 37:** 41-62 (in Persian)

The aim of this study was to investigate the growth and early bearing potential of some commercial and fire blight resistant pear cultivars on OH × F87^{TM} rootstock and to compare this rootstock with the commercial semi-dwarf Pyrodwarf rootstock. The pear cultivars were Louise Bonne, Dargazi, Spadona as the three most popular pear cultivars in Iran, and two newly introduced cultivars, Super Elliot and Packham`s Triumph, which have been evaluated under Karaj climatic conditions for four years (2017-20). The rootstocks were micro-propagated from virus free materials and the trees were two year old nursery plants. The tallest tree height was observed in cultivars Dargazi on both OH × F87^{TM} and Pyrodwarf rootstocks and also the highest spur density was 12 spurs per meter in three graft combinations of Louise Bonne and Packhams cultivars on OH × F87^{TM} rootstock and Spadona on Pyrodwarf. The use of two year old trees caused early bearing of trees in the first year after planting, and flowering in the second year on OH × F87^{TM} rootstock with about 40 blossoms per tree, while Pyrodwarf had about 37.5 blossoms per tree. The highest fruit yield research period observed in cv. Dargazi and cv. Super Elliot, however, the latter showed high susceptibility to pear psylla. On the other hand, cv. Spadona which normally has a low fruit yield on Pyrodwarf rootstock, had higher fruit yield on OH × F87^{TM} rootstock. In general, OH × F87^{TM} rootstock, due to lower growth and relatively higher fruit yield had high yield index per trunk cross section in grafted trees, and in addition to cv. Dargazi, Louise Bonne also had high yield index per trunk cross section on this rootstock. The results showed that OH × F87^{TM} rootstock can be considered as suitable, and even superior to Pyrodwarf, for pear cultivars in the continuation of this research.

Keywords: Pear, clonal rootstocks, fruit yield, yield efficiency, graft combinations.

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RESEARCH ARTICLE

Biological and Molecular Screening of Some Potato Cultivars and Promising Clones for Resistance to *Potato Virus X* (PVX)

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ABSTRACT

Ahmadvand, R., Javanmard Tousi, H., and Mousa Pour Gorji, A. 2021. Biological and molecular screening of some potato cultivars and promising clones for resistance to *Potato Virus X* (PVX). **Seed and Plant Journal 37:** 63-82 (in Persian).

This study was performed to screen 35 commercial potato cultivars and 24 promising clones for resistance to *Potato virus X* (PVX) using biological and molecular marker assays. To purify and propagate the virus, infected potato samples were inoculated on common globe amaranth (*Gompherena globose*) and then on tobacco and maintained under *in vitro* conditions. The reaction of genotypes to PVX were evaluated based on International Potato Centre (CIP) standard method by mechanical inoculation and grafting under the greenhouse conditions. In mechanical experiment, three plants of each genotype were inoculated and the resistant genotypes were identified based on virus detection by ELISA. To determine the type of resistance, the resistant genotypes were grafted on tomato cv. Rutgers plants infected with PVX in three replications, and their infection by virus was examined using DAS-ELISA, 21 days post inoculation. The results of both experiments showed that 12 commercial potato cultivars and 11 promising clones were extremely resistance (ER) to PVX. Moreover, nine commercial potato cultivars and one promising clone showed hypersensitive resistance (HR) reaction. Twenty-six genotypes showed infection to PVX, at least in one replication, and considered as susceptible to the virus. In addition, resistance genes, *Rx1* and *Rx2*, were successfully amplified in resistant genotypes using specific primers 5RX1 and 106RX2, respectively. However, no PCR product could be detected in the PVX susceptible and HR genotypes which were in accordance with the results of biological assays. Finally, *Rx1* and *Rx2* genes were detected in 13 and seven potato genotypes, respectively. It was concluded that genotypes carrying *Rx1* and *Rx2* genes can be used in potato breeding programs to develop new potato cultivars with desirable agronomic characteristics and resistance to PVX.

Keywords: Potato, extreme resistance, hypersensitive resistance, molecular marker, resistant cultivar.

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RESEARCH ARTICLE

Evaluation and Selection of Safflower (*Carthamus tinctorius* L) Genotypes Under Salinity Stress Conditions

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ABSTRACT

Salehi, M., and Pourdad, S. S. 2021. Evaluation and selection of safflower (*Carthamus tinctorius* L) genotypes under salinity stress conditions. **Seed and Plant Journal 37:** 83-102 (in Persian).

To evaluate safflower genotypes under saline conditions and select tolerant genotype(s),18 safflower genotypes obtained from Dryland Agricultural Research Institute, Iran, were planted at three salinity levels (2, 6, and 12 dS m^{-1}) as main plot and genotypes randomized in subplots using split plots arrangements in randomized complete block design with three replications in Sadough salinity research station, Yazd, Iran, in 2016-17 and 2017-18 growing seasons. Gentypes were selected based on their performance at different salinity levels as well as using stress tolerance indices. The mean reduction in seed yield in the first and second growing season at 12 dS m^{-1} salinity level relative to control was 36% and 51%, respectively. The STI, MP, GMP, HM, Yis, Yip and MSTI1 indices were highly correlated with seed yield in three environments. Using principal component analysis the first component designated stress tolerance and the second component was salinity stress susceptibility. The results of cluster analysis using stress tolerance indices that had high correlations with seed yield showed that genotypes 4, 26, 34 and 35 were superior to control (cv. Faraman) and grouped in one group, however, genotype 6 performed the same as control. Selected genotypes had higher seed yield in three salinity conditions. In conclusion, LRV-57-57, 26-S6-58-11, Local Kurdistan, Isfahan 4 and PI-537682 with average seed yield of 172, 120, 152, 155 and 141 g m^{-2}, at 12 dS m^{-1} salinity level, respectively, were selected as salinity tolerant genotypes.

Keywords: Safflower, seed yield, stress tolerance index, principle component analysis, saline water.

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RESEARCH ARTICLE

Assessment of Seed Yield Stability of Chickpea (*Cicer arietinum* L.) Genotypes Using Parametric and Non-Parametric Statistical Methods

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ABSTRACT

Karimizadeh, R., Pezeshkpour, P., Mirzaee, A., Barzali, M., Keshavarzi, K., and Sharifi, P. 2021. Assessment of seed yield stability of chickpea (*Cicer arietinum* L.) genotypes using parametric and non-parametric statistical methods. **Seed and Plant 37:** 103-126 (in Persian).

Sixteen chickpea genotypes and two commercial cultivars; Adel and Azad as check were evaluated under rainfed conditions using randomized complete block design with three replications at four filed stations; Gachsaran, Gonbad, Khorramabad and Ilam for three cropping seasons (2016-2019). Genotypes 5, 12, 11, 17 and 4 had the highest seed yield. Genotypes 18, 16, 6, and 3 had high seed yield stability based on Shukla variance ($\sigma^2 i$), Wrick's equvalence (Wi), root mean square error (RMSE), S_i^1 and S_i^2 statistics. Genotypes 16 and 18 with regression coefficient close to one, seed yield higher than average yield and the lowest deviation from regression line were the superior genotypes. Analysis of variance using Eberhart and Russell method showed a significant genotype × environment interaction effect (linear) which indicated different response of genotypes to environmental conditions. Genotypes 4, 5, 9, 11, 12, 15, 16 and 18 were the best genotypes based on yield-stability index (YSi). Based on TOP nonparametric statistics, genotypes 5, 12, 15, 9 and 4 were superior genotypes. Based on Lin and Binns priority index, genotypes 12, 5, 11, 17 and 18 were desirable genotypes in all environments. In conclusion, genotypes 4, 5 and 12 can be considered as high yielding with yield stability and suitable for further verification in research and development projects.

Keywords: Chickpea, genotype × environment interaction, priority index, yield rank, adaptation, yield-stability index.

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